AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

Claims 1-15 (canceled).

16. (currently amended): A sensor element comprising negative and positive electrodes disposed on the same side of a solid electrolyte substrate and a circuit for applying an electric potential between said negative electrode and said positive electrode, wherein

the area of said negative electrode and the area of said positive electrode differ by at least twofold ~~and said areas are set such that the element resistance measured between the negative and positive electrodes is minimized,~~

~~at least one of said negative electrode and said positive electrode is embedded in the solid electrolyte substrate; and~~

~~the area ratio of the negative and positive electrodes is such that the element resistance measured between the negative and positive electrodes is 94% or less than the element resistance of the same sensor except in which the negative electrode and the positive electrode have the same area~~.

17. (previously presented): The sensor element as claimed in claim 16, wherein the ratio of the area of the negative electrode to the area of the positive electrode is within the range of 2:1 to 5:1, the circuit applies an electric potential of from 0.2 V to 1.1 V, and the element resistance measured between the negative and positive electrodes is from 94% to 86% of the

element resistance of the same sensor except in which the negative electrode and the positive electrode have the same area.

18. (previously presented): The sensor element as claimed in claim 16, wherein the ratio of the area of the negative electrode to the area of the positive electrode is within the range of 2:1 to 5:1, the circuit applies an electric potential of from 1.1 V to 2.5 V, and the element resistance measured between the negative and positive electrodes is from 81% to 63% of the element resistance of the same sensor except in which the negative electrode and the positive electrode have the same area.

E1 Cont'd

19. (previously presented): The sensor element as claimed in claim 16, wherein the ratio of the area of the negative electrode to the area of the positive electrode is within the range of 1:2 to 1:5, the circuit applies an electric potential of from 0.2 V to 1.1 V, and the element resistance measured between the negative and positive electrodes is from 74% to 73% of the element resistance of the same sensor except in which the negative electrode and the positive electrode have the same area.

20. (previously presented): The sensor element as claimed in claim 16, wherein the ratio of the area of the negative electrode to the area of the positive electrode is within the range of 1:2 to 1:5, the circuit applies an electric potential of from 1.1 V to 2.5 V, and the element resistance measured between the negative and positive electrodes is from 90% to 82% of the element resistance of the same sensor except in which the negative electrode and the positive electrode have the same area.

21. (canceled).

22. (previously presented): The sensor as claimed in claim 16, wherein said solid electrolyte substrate comprises zirconia.

23. (previously presented): The sensor as claimed in claim 16, wherein the negative and positive electrodes comprise porous platinum.

E 1 cont'd

24. (previously presented): A flat current-limiting sensor comprising a sensor element according to claim 16.

Claims 25-29 (canceled).

30. (currently amended): A sensor for detecting an amount of a gas, comprising

an oxygen-ion conductive solid electrolyte substrate having a flat side, a negative electrode and a positive electrode formed on the same flat side of the substrate so as to pump oxygen from the negative electrode to the positive electrode, and a gas diffusion limiting means for limiting the gas diffusing into the negative electrode,

wherein the ratio of the area of said negative electrode to the area of said positive electrode is set within a range of 2:1 to 5:1~~ such that the element resistance measured between the negative and positive electrodes is minimized~~, and

said sensor comprising a circuit for applying an electric potential between said negative and positive electrodes such that a pump current~~ of less than 100 microamperes~~ flows between

the negative and positive electrodes when the sensor is used for detecting the amount of a gas, said pump current being a measurement of the amount of gas.

31. (currently amended): A sensor for detecting an amount of a gas, comprising

an oxygen-ion conductive solid electrolyte substrate having a flat side, a negative electrode and a positive electrode formed on the same flat side of the substrate so as to pump oxygen from the negative electrode to the positive electrode, and a gas diffusion limiting means for limiting the gas diffusing into the negative electrode,

E1 cont'd

wherein the ratio of the area of said negative electrode to the area of said positive electrode is set within a range of 1:2 to 1:5~~ such that the element resistance measured between the negative and positive electrodes is minimized~~, and

said sensor comprising a circuit for applying an electric potential between said negative and positive electrodes such that a pump current~~ of less than 100 microamperes~~ flows between the negative and positive electrodes when the sensor is used to detect the amount of a gas, said pump current being a measurement of the amount of gas.

32. (currently amended): An oxygen sensor for determining the oxygen concentration of a gas, comprising first and second chambers (62, 64) formed between first and second oxygen ion conductive cell substrates (66, 68) and first and second electrodes (68a, 68b) formed on the same plane of the second cell substrate (68), said first electrode (68a) being formed on an inside wall of the second chamber (64) and said second electrode (68b) being formed outside of the second chamber (64),

wherein the area of the first electrode is at least twofold larger than that of the second electrode ~~and said areas are set such that the element resistance measured between the negative and positive electrodes is minimized~~, and

the ~~second~~ sensor comprises ~~a circuit~~ means for applying an electric potential in the range of 0.2 V to 1.1 V between the first and second electrodes such that a pump current ~~of less than 100 microamperes~~ flows between the first and second electrodes when the sensor is used to determine the concentration of oxygen in a gas, said pump current being a measurement of oxygen concentration.

E1 Cont'd

33. (currently amended): A humidity sensor for determining the humidity of a gas, comprising first and second chambers (62, 64) formed between first and second oxygen ion conductive cell substrates (66, 68) and first and second electrodes (68a, 68b) formed on the same plane of the second cell substrate (68), said first electrode (68a) being formed on an inside wall of the second chamber (64) and said second electrode (68b) being formed outside of the second chamber (64),

wherein the area of the first electrode is at least twofold larger than that of the second electrode ~~and said areas are set such that the element resistance measured between the negative and positive electrodes is minimized~~, and

the sensor comprises ~~a circuit~~ means for applying an electric potential in the range of 1.1 V to 2.5 V between the second electrodes such that a pump current ~~of less than 10 microamperes~~ flows between the first and second electrodes when the sensor is used to determine the humidity of a gas, said pump current being a measurement of humidity.

34. (currently amended): An oxygen sensor for determining the oxygen concentration as a component of a gas containing NOx, comprising first and second chambers (62, 64) formed between first and second oxygen ion cell substrates (66, 68) and first and second electrodes (68a, 68b) formed on the same plane of the second cell substrate (68), said first electrode (68a) being formed on an inside wall of the second chamber (64) and said second electrode (68b) being outside of the second chamber (64),

E 1 cont'd

wherein the area of the first electrode is at least twofold larger than that of the second electrode ~~and said areas are set such that the element resistance measured between the negative and positive electrodes is minimized~~, and

the sensor comprises ~~a circuit~~ means for applying an electric potential in the range of 0.2 V to less than 0.5 V such that a pump current ~~of less than 100 microamperes~~ flows between the first and second electrodes when the sensor is used to determine oxygen concentration as a component of a gas containing NOx, said pump current being a measurement of oxygen concentration.

35. (currently amended): The oxygen sensor as claimed in ~~claim 35~~ claim 34, comprising a circuit for applying an electric potential in the range of 0.2 V to less than 0.5 V such that a pump current of less than 10 microamperes flows between the first and second electrodes when the sensor is used to determine oxygen concentration as a component of a gas containing NOx, said pump current being a measurement of oxygen concentration.

36. (new): A sensor for detecting the amount of a gas, comprising:

a first oxygen ion pump cell (66), an oxygen-concentration-measuring cell (67), and a second oxygen ion pump cell (68), which are sequentially arranged in layers;

the first oxygen ion pump cell (66) including a first solid electrolyte layer and electrodes (66a) and (66b) provided on opposite sides of the first solid electrolyte layer;

the oxygen-concentration-measuring cell (67) including a second solid electrolyte layer and oxygen partial-pressure detection electrodes (67a) and (67b) provided on opposite sides of the second solid electrolyte layer;

the second oxygen ion pump cell (68) including a third oxygen ion conductive solid electrolyte layer and oxygen pump electrodes (68a) and (68b) provided on the same side of the third oxygen ion conductive solid electrolyte layer;

a first measurement chamber (62) defined by the first oxygen ion pump cell (66);

a second measurement chamber (64) defined by the second oxygen ion pump cell (68);.

first and second diffusion holes (61) and (63) located apart from one another and serving as serial passageways for transmission of measurement gas from outside of the sensor toward the electrode (68a) via diffusion resistance,

said second diffusion hole (63) extending through the oxygen-concentration-measuring cell (67) and the second solid electrolyte layer to establish communication between the first and second measurement chambers (62) and (64); and

said oxygen ion pump electrodes (68a) and (68b) differing in area by at least twofold.